

# Claims

- [c1] 1. An imaging system for use in medical intervention procedure planning, comprising:
- a medical scanner system for generating a volume of cardiac image data;
  - a data acquisition system for acquiring the volume of cardiac image data;
  - an image generation system for generating at least one viewable image from the volume of cardiac image data;
  - a database for storing information from said data acquisition and image generation systems;
  - an operator interface system for managing at least one of said medical scanner system, said data acquisition system, said image generation system, and said database;
  - a post-processing system for analyzing the volume of cardiac image data and displaying the at least one viewable image and being responsive to said operator interface system; and wherein
- said operator interface system comprises instructions for using the volume of cardiac image data and the at least one viewable image in at least one of a bi-ventricular pacing planning, an atrial fibrillation planning, an atrial

flutter planning procedure, and location and navigation of an interventional tool.

- [c2] 2.The imaging system of Claim 1, wherein said medical scanner system comprises at least one of a CT system, a MR system, an Ultrasound system, a 3D Fluoroscopy system, and a PET system.
- [c3] 3.The imaging system of Claim 1, wherein said database includes storage for storing image data of at least one of a right atrium, a left atrium, a left ventricle, and a coronary sinus.
- [c4] 4.The imaging system of Claim 1, wherein said database includes storage for storing the at least one viewable image of at least one of the right atrium and the coronary sinus.
- [c5] 5.The imaging system of Claim 1, wherein said operator interface system includes instructions for segmenting the volume of cardiac image data for viewing at least one of a right atrium, a left atrium, a left ventricle, and a coronary sinus.
- [c6] 6.The imaging system of Claim 5, wherein said operator interface system includes instructions for viewing the at least one viewable image in different planes.

- [c7] 7.The imaging system of Claim 5, wherein said post-processing system includes instructions for performing vessel tracking of the coronary sinus from the volume of cardiac image data.
- [c8] 8.The imaging system of Claim 7, wherein said instructions further include instructions for performing vectorial vessel tracking along the centerline of the viewable image of the coronary sinus.
- [c9] 9.The imaging system of Claim 1, wherein said post-processing system is adapted to display the at least one viewable image in at least one of a three-dimensional surface rendering, a three-dimensional inner surface rendering, a three-dimensional volume rendering, a three-dimensional segmented model view, MPVR, MIP, curved reformat, lumen view, and an immersible view.
- [c10] 10.The imaging system of Claim 9, wherein said post-processing system is further adapted to display a viewable image of at least one of the heart, a coronary sinus, a left ventricle, a left atrium, and a right atrium.
- [c11] 11.The imaging system of Claim 10, wherein said post-processing system is further adapted to display a geometric marker at an anatomical or external landmark.
- [c12] 12.The imaging system of Claim 11, wherein said post-

processing system is further adapted to display a viewable image of the coronary sinus in a translucent fashion and the geometric landmark in an opaque fashion.

[c13] 13. The imaging system of Claim 10, wherein said post-processing system is further adapted to display a first image of at least one of the heart, coronary sinus, left ventricle, left atrium, and right atrium in one of a translucent fashion and an opaque fashion while a second image of the coronary sinus is displayed in one of the translucent fashion and opaque fashion opposite the first image.

[c14] 14. A computer system for use in a medical intervention procedure, comprising:

- a data port for receiving probe information from the medical intervention procedure;
- a database for storing information acquired from an interventional procedure planning session;
- a memory comprising instructions for managing the probe information received at said data port and the stored information in said database;
- a processor for analyzing the information at said data port in combination with the stored information in said database;
- an operator interface system for managing said memory and said processor; and

a display responsive to said operator interface for visualizing the information in said database in combination with the information at said data port.

[c15] 15.The computer system of Claim 14, further comprising:

a display responsive to said operator interface for visualizing real-time vessel tracking of at least one of a coronary sinus or a coronary artery.

[c16] 16.A method for generating an image for use in medical intervention procedure planning, comprising:

acquiring a volume of cardiac image data from a medical scanner;

managing the volume of cardiac image data through segmentation;

processing the cardiac image data for viewing;

viewing the cardiac image data in at least one viewable image;

inserting a geometric marker into the volume of cardiac image data at an anatomical landmark for subsequent visualization, analysis and registration;

selecting a viewable parameter in response to the geometric marker at the anatomical landmark; and

saving at least one of at least one viewable image, an anatomical landmark, and a measured viewable parameter, in an image database.

[c17] 17.The method for generating an image as set forth in Claim 16, further comprising:  
exporting at least one 3D model containing the saved information to an image database;  
importing the at least one 3D model into an operator interface system;  
registering the at least one 3D model with the corresponding selected anatomical landmark and measured viewable parameter; and  
visualizing the at least one 3D model at the operator interface system with the selected viewable parameters mapped thereon.

[c18] 18.The method for generating an image as set forth in Claim 16, wherein said acquiring a volume of cardiac image data further comprises:  
acquiring a volume of cardiac image data using at least one of a CT system, a MR system, an Ultrasound system, a 3D Fluoroscopy system, and a PET system.

[c19] 19.The method of generating an image as set forth in Claim 16, wherein said managing the volume of cardiac image data further comprises:  
segmenting the volume of cardiac image data for viewing at least one of a right atrium, a left ventricle, a left atrium, and a coronary sinus.

- [c20] 20. The method of generating an image as set forth in Claim 16, wherein said processing the cardiac image data further comprises:  
processing the cardiac image data for viewing at least one of a three-dimensional model, a three-dimensional surface rendering, a three-dimensional inner surface rendering, a three-dimensional volume rendering, a three-dimensional segmented model view, MPVR, MIP, curved reformat, lumen view, and an immersible view.
- [c21] 21. The method of generating an image as set forth in Claim 20, wherein said processing the cardiac image data further comprises:  
processing the cardiac image data for viewing at least one of a coronary sinus, a left ventricle, a left atrium, and a right atrium.
- [c22] 22. The method of generating an image as set forth in Claim 21, further comprising:  
performing vessel tracking of the coronary sinus from the volume of cardiac image data.
- [c23] 23. The method of generating an image as set forth in Claim 22, further comprising:  
performing vectorial vessel tracking along the centerline of the immersible view of the coronary sinus.

- [c24] 24. The method of generating an image as set forth in Claim 16, wherein said inserting a geometric marker into the volume of cardiac image data further comprises: inserting a geometric marker at an anatomical landmark identifying at least one substructure of a coronary sinus, a left ventricle, a left atrium, and a right atrium.
- [c25] 25. The method of generating an image as set forth in Claim 16, wherein said selecting a viewable parameter further comprises:  
selecting a viewable parameter of the coronary sinus vessel wherein the viewable parameter comprises at least one of a vessel diameter, a vessel segment path length, and a degree of vessel curvature.
- [c26] 26. The method of generating an image as set forth in Claim 25, further comprises:  
measuring the viewable parameter.
- [c27] 27. The method of generating an image as set forth in Claim 24, wherein said viewing the cardiac image data further comprises:  
viewing the at least one viewable image of the coronary sinus in a translucent fashion and viewing the geometric landmark in an opaque fashion.
- [c28] 28. The method of generating an image as set forth in



Claim 16, wherein said viewing the cardiac image data further comprises:

viewing a first image of at least one the heart, coronary sinus, left ventricle, left atrium, and right atrium in one of a translucent fashion and opaque fashion and viewing a second image of the coronary sinus in one of the translucent fashion and opaque fashion opposite the first image.

[c29] 29.The method of generating an image as set forth in Claim 17, wherein said exporting a 3D model further comprises:

exporting a 3D model in at least one of a wire mesh geometric model, a solid geometric model, a set of contours associated with each image slice, a segmented volume of binary images, a run-length encoded binary segmentation mask, and a medical digital imaging object using a radiation therapy medical digital imaging object standard.

[c30] 30.The method of generating an image as set forth in Claim 17, wherein said visualizing the 3D model further comprises:

viewing the 3D model in different planes.

[c31] 31.A method for using a volume of cardiac image data during a medical interventional procedure, comprising:

retrieving at least one procedure planning image from an image database;  
viewing the at least one procedure planning image;  
applying a probe into one of a vessel and a heart chamber of a patient during the interventional procedure;  
identifying a landmark of one of the probed vessel and heart chamber from the interventional procedure;  
registering the coordinate system of the interventional procedure with the coordinate system of the at least one procedure planning image; and  
displaying the procedure planning image in response to the position of the applied probe for performing a real-time vessel tracking and navigation procedure on the probed vessel or chamber.

[c32] 32.The method for using a volume of cardiac image data set forth in Claim 31, wherein said displaying the procedure planning image further comprises:  
displaying a real-time vessel tracking of at least one of a coronary sinus or a coronary artery.

[c33] 33.The method for using a volume of cardiac image data set forth in Claim 32, wherein:  
said applying a probe comprises applying a catheter; and  
said displaying the procedure planning image further comprises displaying the location of the catheter.

- [c34] 34.A system for a medical intervention procedure within a cardiac chamber comprising:  
an imaging system for obtaining image data of a cardiac chamber and for creating a 3D model of the cardiac chamber from the image data; and  
an interventional system for registering the 3D model with a real-time image of the cardiac chamber and for displaying the 3D model.
- [c35] 35.The system of claim 34 further comprising:  
an interventional tool for the medical intervention procedure, the tool being displayed upon the interventional system and navigated in real-time over the registered 3D model.
- [c36] 36.The system of claim 34 further comprising a storage medium for storing the 3D model and wherein the interventional system receives the stored 3D model for registering the 3D model.
- [c37] 37.The system of claim 34 wherein the imaging system is a CT system.
- [c38] 38.The system of claim 35 wherein the interventional tool is a mapping-ablation catheter.
- [c39] 39.The system of claim 35 wherein the interventional system is a fluoroscopy system.

- [c40] 40.A method for a medical intervention procedure within a cardiac chamber including vessels thereof comprising: obtaining image data of a cardiac chamber from an imaging system; creating a 3D model of the cardiac chamber from the image data; registering the 3D model with a real-time image on an interventional system; displaying the registered 3D model on the interventional system; positioning an interventional tool in the cardiac chamber; displaying the interventional tool over the registered 3D model on the interventional system; and navigating the interventional tool in the cardiac chamber using the registered 3D model.
- [c41] 41.The method of claim 40 wherein the 3D model includes endocardial views of the cardiac chamber.
- [c42] 42.The method of claim 40 wherein the imaging system is a CT system.
- [c43] 43.The method of claim 40 wherein the interventional tool is a mapping-ablation catheter.
- [c44] 44.The method of claim 40 wherein the interventional system is a fluoroscopy system.

[c45] 45. Method of claim 40 further comprising:  
storing the 3D model in a storage medium; and  
transferring the stored 3D model to the interventional  
system for registering the 3D model.